

he became quite certain that the movement could not be accounted for by any residuum of the force which he had himself communicated, his astonishment developed into dread, and he ran to conceal himself under some articles of furniture, there to behold at a distance the "uncanny" spectacle of a dry bone coming to life.

Now in this, and in all my other experiments, I have no doubt that the behaviour of the terrier arose from his *sense of the mysterious*, for he was of a highly pugnacious disposition, and never hesitated to fight an animal of any size or ferocity; but apparent symptoms of spontaneity in an inanimate object which he knew so well, gave rise to feelings of awe and horror which quite enervated him. And that there was nothing *fetichistic* in these feelings may be safely concluded if we reflect, with Mr. Spencer, that the dog's knowledge of causation, for all immediate purposes, being quite as correct and no less stereotyped than is that of "primitive man," when an object of a class which he knew from uniform past experience to be inanimate suddenly began to move, he must have felt the same oppressive and alarming sense of the mysterious which uncultured persons feel under similar circumstances. But further, in the case of this terrier we are not left with *à priori* inferences alone to settle this point, for another experiment proved that the sense of the mysterious was in this animal sufficiently strong of itself to account for his behaviour. Taking him into a carpeted room I blew a soap-bubble, and by means of a fitful draught made it intermittently glide along the floor. He became at once intensely interested, but seemed unable to decide whether or not the filmy object was alive. At first he was very cautious and followed it only at a distance, but as I encouraged him to examine the bubble more closely, he approached it with ears erect and tail down, evidently with much misgiving; and the moment it happened to move he again retreated. After a time, however, during which I always kept at least one bubble on the carpet, he began to gain more courage, and the scientific spirit overcoming his sense of the mysterious, he eventually became bold enough slowly to approach one of the bubbles and nervously to touch it with his paw. The bubble, of course, immediately vanished; and I certainly never saw astonishment more strongly depicted. On then blowing another bubble, I could not persuade him to approach it for a good while; but at last he came and carefully extended his paw as before with the same result. But after this second trial nothing would induce him again to approach a bubble, and on pressing him he ran out of the room, which no coaxing would persuade him to re-enter.

One other example will suffice to show how strongly developed was the sense of the mysterious in this animal. When alone with him in a room I once purposely tried the effect on him of making a series of horrible grimaces. At first he thought I was only making fun; but as I persistently disregarded his caresses and whining while I continued unnaturally to distort my features, he became alarmed and slunk away under some furniture, shivering like a frightened child. He remained in this condition till some other member of the family happened to enter the room, when he emerged from his hiding-place in great joy at seeing me again in my right mind. In this experiment, of course, I refrained from making any sounds or gesticulations, lest he might think I was angry. His actions, therefore, can only be explained by his horrified surprise at my apparently irrational behaviour—*i.e.*, by the violation of his ideas of uniformity in matters psychological. It must be added, however, that I have tried the same experiment on less intelligent and less sensitive terriers with no other effect than causing them to bark at me.

I will only add that I believe the sense of the mysterious to be the cause of the dread which many animals show of *thunder*. I am led to think this, because I once had a setter which never heard thunder till he was eighteen months old, and on then first hearing it I thought he was

about to die of fright, as I have seen other animals do under various circumstances. And so strong was the impression which his extreme terror left behind, that whenever afterwards he heard the boom of distant artillery practice, mistaking it for thunder, he became a pitiable object to look at, and, if out shooting, would immediately bolt home—or, if at a great distance from home, would endeavour to bury himself. After having heard real thunder on two or three subsequent occasions, his dread of the distant cannons became greater than ever; so that eventually, though he keenly enjoyed sport, nothing would induce him to leave his kennel, lest the practice might begin when he was at a distance from home. But the keeper, who had a large experience in the training of dogs, assured me that if I allowed this one to be taken to the battery, in order that he might learn the true cause of the thunder-like noise, he would again become serviceable in the field. The animal, however, died before the experiment was made.

GEORGE J. ROMANES

RUHMKORFF

WE regret to record the sudden death on December 20, at Paris, of Henry Daniel Ruhmkorff, whose name is so closely connected with the history of magneto-electricity. He was born in Hanover, Germany, in 1803, and but little is known of his early life. In 1819 he wandered to Paris, and obtained a position as porter in the laboratory of Prof. Charles Chevalier, at that time one of the leading French physicists. Here he displayed a remarkable fondness for electrical apparatus, as well as ingenuity in its arrangement, and was enabled shortly after to start a modest manufactory of physical apparatus. Through the efforts of Chevalier and the excellence of the work performed, the business was rapidly extended. In 1844 Ruhmkorff brought out his first invention, a convenient thermo-electric battery. Soon after he turned his attention to magneto-electricity, especially the production of the induced currents, discovered by Faraday in 1832. A long series of experiments resulted in the appearance, in 1851, of the famous "Ruhmkorff coil," with its later modifications, the most important piece of apparatus in this branch of physics. With this powerful adjunct the electrician was enabled to obtain sparks 18 inches in length, pierce thick plates of glass, and carry out a vast variety of experiments. The invention was rewarded by a decoration and medal at the Exhibition of 1855, while in 1858 it received the first prize of 50,000 francs at the French Exhibition of Electrical Apparatus. Since then the manufacture of the coils and of electrical machines in general has assumed enormous dimensions, and the leading physicists of Europe are well acquainted with the dingy little bureau in the Rue Champollion, near the University. Personally M. Ruhmkorff was of a quiet, dignified appearance, and despite the disadvantages of his early life, he enjoyed the friendship of the leading Parisian *savants*, and was an honoured member of the French Physical Society. M. Jamin delivered an address over the grave, in which he stated that Ruhmkorff died almost a poor man, because he had spent all his earnings on behalf of science and in works of benevolence.

LIQUEFACTION OF OXYGEN

THE number of the permanent gases is rapidly diminishing. We have had occasion recently to refer to M. Cailletet's successful attempts to compress nitric oxide, N_2O_2 , methyl hydride, CH_4 , and acetylene, C_2H_2 , to the liquid form. The list of non-compressible gases was thus reduced to three, viz., hydrogen, nitrogen, and oxygen. Within the past week M. Raoul Pictet has succeeded in obtaining the last-mentioned gas in the liquid state, an event which is certainly one of the most

novel and interesting in the chemical progress of the expiring year.

The *Journal de Genève* of December 23] gives the following account of the experiments:—

One of the most interesting physical experiments of our time has just been made at Geneva with rare success in the laboratory of the Society for the Manufacture of Physical Instruments. M. Raoul Pictet has succeeded in obtaining, by means of ingeniously combined apparatus, the liquefaction of oxygen gas. The following is the process by which the curious result was obtained:—

By a double circulation of sulphurous acid and carbonic acid, the latter gas is liquefied at a temperature of 65° of cold, under a pressure of from four to six atmospheres. The liquefied carbonic acid is conducted into a tube four metres long; two combined pumps produce a barometric vacuum over the acid which is solidified in consequence of the difference of pressure. Into the interior of this first tube containing solidified carbonic acid is passed a tube of a slightly less diameter, in which circulates a current of oxygen produced in a generator containing chlorate of potash and the form of which is that of a large shell thick enough to prevent all danger of explosion. The pressure may thus be carried to 800 atmospheres.

Yesterday morning (December 22), all the apparatus being arranged as described, and under a pressure which did not exceed 300 atmospheres, a liquid jet of oxygen issued from the extremity of the tube, at the moment when this compressed and refrigerated gas passed from that high pressure to the pressure of the atmosphere.

The great scientific interest of this experiment is that it demonstrates experimentally the truth of the mechanical theory of heat, by establishing that all gases are vapours capable of passing through the three states—solid, liquid, and gaseous. Only twenty days ago M. Cailletet, as we have said, succeeded in liquefying the bioxide of nitrogen, under a pressure of 146 atmospheres and at a temperature of 11° of cold. After the experiment of M. Raoul Pictet there remain not more than two elemental gases which have hitherto escaped the attempt at liquefaction—hydrogen and nitrogen.

The experiment above described was to be repeated on Monday and subsequent days, with some slight changes in the processes and the arrangement of the apparatus.

NOTES

SOME interesting experiments with the telephone have been made by Mr. W. H. Preece between Dublin and Holyhead through the submarine cable. Conversation was freely maintained and songs were sung on each side and heard and appreciated on the other. The articulation was excellent, but muffled, as though the speakers spoke through respirators. This is what might have been expected from the static induction of the cable. It is the longest actual cable yet spoken through, its length being sixty-seven miles.

At their last sitting the enlarged Council of the Paris Observatory were occupied in considering the question of the position of French meteorology. M. Dumesnil, the representative of the minister, was obliged to silence some members of the minority who were assailing the character of some of the physicists having the control of the Observatory and the transmission of the warnings to the sea-ports. A large majority rendering justice to the ingenuity displayed and to the highly scientific nature of the warnings, passed a vote recommending the administration not to alter the present condition of things at the Observatory.

DR. CARLO GHINOZZI, Professor of Medical Clinic at the Istituto Superiore of Florence, for many years colleague and afterwards successor of Prof. Bufalini, died on Saturday, the 15th instant, at the age of 66 years.

IN Bonn a committee has been formed consisting of leading citizens and Professors Bauerband, Kekulé, and Proschel, of the University, for the purpose of erecting a monument to the late Prof. Jacob Noeggerath, whose death last September we briefly alluded to at the time. Prof. Noeggerath was born in Bonn October 10, 1788, and since the foundation of the university in 1818 had been connected with it as Professor of Mineralogy. As a successful teacher of the natural sciences he acquired an unusually widespread fame, and the majority of the present Prussian mining officials pursued their studies under his direction. His general scientific researches touch on a number of interesting geological questions, such as the formation of basalt, &c.; but his chief efforts were directed to an exhaustive study of the mineralogy and geology of Rhentish Westphalia, the results of which are to be seen in the magnificent mineralogical collection at Bonn, and the rapid development of the mining interests in this district. As a favourite writer of popular works on scientific subjects, he contributed in no small degree to the general taste for this class of literature now prevalent in Germany.

THE expedition sent out by the Dutch Geographical Society for the exploration of Sumatra has met with a severe check by the sudden death of its leader, M. Schouw Landvort. His extensive knowledge, indomitable perseverance, and great powers of endurance, fitted him eminently for the position, these qualities being notably evidenced by the bold journey across the middle of the island, through hitherto unknown regions, in the company of natives only, which we had occasion lately to chronicle.

At the meeting of the Council of the Zoological Society on Wednesday last week, the president, the Marquis of Tweeddale, proposed that the silver medal of the Society should be awarded to Mr. Robert Hudson, F.R.S., in acknowledgment of the valuable services he had rendered to the Society for the fifty years that he had been a Fellow thereof. The motion was carried unanimously at the full meeting of the Council.

THE organisation of public instruction in France is undergoing an exceedingly beneficial change. A decree, published in the *Journal Officiel* of December 17, establishes a representative Council of Public Instruction under the title of "Comité Consultatif." The committee is divided into three different sections corresponding to the three divisions of public instruction in France, primary, secondary (grammar schools), and superior (universities). Each section is to appoint its president and secretary. The three sections in general session are to be presided over by the minister. Some of the members are appointed by the minister to serve during a period of five years, others are members *ex officio*. The minister cannot elect any who are not members of the teaching body or of the Institut. The directors of the administration of primary, secondary, or superior instruction are *ex officio* members of their respective sections. They meet yearly at a certain fixed period. The opinion of the committee is not binding, but it must be taken on a number of matters, such as bills which are to be presented to Parliament, modification of programmes, &c. Another decree appoints the members of the three committees. Among these are many names well-known to science, as MM. Laboulaye, Würtz, Claude Bernard, Vulpian, Gavarret, Chevreul, Faye, Berthelot, Milne-Edwards, Puiseux, and Desains.

THE following are the probable arrangements for the Friday Evening Meetings at the Royal Institution, before Easter, 1878:—January 25, Prof. Huxley, F.R.S., "William Harvey;" February 1, Wm. Henry Preece, C.E., "The Telephone;" February 8, Matthew Arnold, "Equality;" February 15, P. L. Sclater, F.R.S., "Zoological Distribution and some of its Difficulties;" February 22, Prof. Roscoe, F.R.S.; March 1, Richard Liebreich, M.D., "The Deterioration of Oil Paintings;" March 8, Prof. Goldwin Smith, "The Influence of